

**APPLICATION**

**FOR UNITED STATES LETTERS PATENT**

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**SPECIFICATION**

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT I, **Ronald J. Hoffart**, a citizen of the United States,  
have invented a new and useful implement mounting system of which the following is  
a specification:

1 **Implement Mounting System**

2  
3 **CROSS REFERENCE TO RELATED APPLICATIONS**

4 I hereby claim benefit under Title 35, United States Code, Section 120 of  
5 United States patent application Serial Number 10/622,961 filed July 18, 2003. This  
6 application is a continuation of the 10/622,961 application. The 10/622,961  
7 application is currently pending. The 10/622,961 application is hereby incorporated by  
8 reference into this application.  
9

10 Two other utility patent applications have been filed with the USPTO by the  
11 applicant identified by U.S. Patent Application Nos. 10/622,959 and 10/622,964. Both  
12 applications were filed on July 18, 2003.  
13

14 **STATEMENT REGARDING FEDERALLY**  
15 **SPONSORED RESEARCH OR DEVELOPMENT**

16 Not applicable to this application.  
17

18 **BACKGROUND OF THE INVENTION**  
19  
20  
21

22 **Field of the Invention**  
23

24 The present invention relates generally to implement mounting arrangements  
25 for tractors and similar vehicles, and more specifically it relates to an implement  
26 mounting system for providing a lightweight structure capable of moving along 3 main  
27 axes for use upon small to mid-sized tractors.  
28  
29

## **Description of the Related Art**

Conventional implement mounting arrangements have been in use for years for mounting various types of implements to tractors and like vehicles. Implements mounted to these structures range from loaders, blades, belly blades, rollers, brushes and the like. A typical implement mounting arrangement is the front-end loader commonly utilized upon small to large tractors.

Another type of implement mounting arrangement is comprised of a belly structure that is attached beneath the frame of a tractor preferably capable of operating about various axes to provide lift, roll, pitch and yaw to an implement. The belly structure typically has a support frame with side members and a rear support, a pair of support arms pivotally extending forwardly from the rear support, and an attachment structure that is movably attached to the distal portions of the support arms by a connecting structure. The connecting structure sometimes rotatably positioned within the support arms to allow for "rolling" of the implement. A pair of vertical actuators are attached on opposing sides to the connecting structure to provide both lift and roll to the belly mounting structure. U.S. Patent No. 6,059,048 illustrates a recently patented belly mounting structure design that has these features and the below inherent limitations.

The main problem with conventional belly mounting structures is that they require the user to mount the vertical actuators to the front portion of the tractor thereby interfering with attachment of a conventional front-end loader (conventional front-end loaders are attached to the front portion of the tractor frame). Another problem with conventional belly mounting structures is that they tend to be heavy and bulky since they have at least two support arms extending forwardly from the rear support. A further problem with conventional belly mounting structures is that they

1 require the usage of heavy duty pivot joints and materials near the front portion  
2 thereof.

3  
4 While these devices may be suitable for the particular purpose to which they  
5 address, they are not as suitable for providing a lightweight structure capable of  
6 moving along 3 main axes. Conventional implement mounting devices are bulky and  
7 difficult to utilize upon small to mid-sized tractors.

8  
9 In these respects, the implement mounting system according to the present  
10 invention substantially departs from the conventional concepts and designs of the prior  
11 art, and in so doing provides an apparatus primarily developed for the purpose of  
12 providing a lightweight structure capable of moving along 3 main axes.

1

2                   **BRIEF SUMMARY OF THE INVENTION**

3

4           In view of the foregoing disadvantages inherent in the known types of belly  
5 mounting structures now present in the prior art, the present invention provides a new  
6 implement mounting system construction wherein the same can be utilized for  
7 providing a lightweight structure capable of moving along 3 main axes for use upon  
8 small to mid-sized tractors.

9

10          The general purpose of the present invention, which will be described  
11 subsequently in greater detail, is to provide a new implement mounting system that has  
12 many of the advantages of the belly mounting structures mentioned heretofore and  
13 many novel features that result in a new implement mounting system which is not  
14 anticipated, rendered obvious, suggested, or even implied by any of the prior art belly  
15 mounting structures, either alone or in any combination thereof.

16

17          To attain this, the present invention generally comprises a support frame having  
18 a pair of side supports and a rear support, a ball joint attached to the rear support, and a  
19 support arm movably attached to the ball joint for rotating about 3 main axes. A brace  
20 member is attached between the support frame and the support arm for reducing the  
21 amount of side-to-side movement of the support arm. The ball joint is comprised of a  
22 ball-and-socket structure for providing various pivoting movements of the support  
23 arm.

24

25          There has thus been outlined, rather broadly, the more important features of the  
26 invention in order that the detailed description thereof may be better understood, and  
27 in order that the present contribution to the art may be better appreciated. There are  
28 additional features of the invention that will be described hereinafter and that will form  
29 the subject matter of the claims appended hereto.

1  
2 In this respect, before explaining at least one embodiment of the invention in  
3 detail, it is to be understood that the invention is not limited in its application to the  
4 details of construction and to the arrangements of the components set forth in the  
5 following description or illustrated in the drawings. The invention is capable of other  
6 embodiments and of being practiced and carried out in various ways. Also, it is to be  
7 understood that the phraseology and terminology employed herein are for the purpose  
8 of the description and should not be regarded as limiting.

9  
10 A primary object of the present invention is to provide an implement mounting  
11 system that will overcome the shortcomings of the prior art devices.

12  
13 A second object is to provide an implement mounting system for providing a  
14 lightweight structure capable of moving along 3 main axes for use upon small to mid-  
15 sized tractors.

16  
17 Another object is to provide an implement mounting system that may be  
18 utilized upon various types and sizes of vehicles.

19  
20 An additional object is to provide an implement mounting system that is  
21 capable of supporting various types of implements such as but not limited to a belly  
22 blade, plow, a roller and a brush.

23  
24 A further object is to provide an implement mounting system that does not  
25 interfere with a front-end loader attached to a tractor.

26  
27 Another object is to provide an implement mounting system that is comprised  
28 of a simple structure and simple to attach to a tractor.

1           Other objects and advantages of the present invention will become obvious to the  
2 reader and it is intended that these objects and advantages are within the scope of the  
3 present invention.

4  
5           To the accomplishment of the above and related objects, this invention may be  
6 embodied in the form illustrated in the accompanying drawings, attention being called  
7 to the fact, however, that the drawings are illustrative only, and that changes may be  
8 made in the specific construction illustrated and described within the scope of the  
9 appended claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will become fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

FIG. 1 is a top view of the present invention.

FIG. 2 is an upper perspective view of the present invention.

FIG. 3 is a rear perspective view of the present invention illustrating the rolling of the implement upwardly on the left side.

FIG. 4 is a rear perspective view of the present invention illustrating the rolling of the implement upwardly on the right side.

FIG. 5 is a side view of the present invention in an elevated position.

FIG. 6 is a side view of the present invention in a lowered position.

FIG. 7 is an upper perspective view of the present invention.

FIG. 8 is a top view of the present invention.

FIG. 9 is a cross sectional view taken along line 9-9 of Figure 8.



1           FIG. 10 is a top view of the present invention showing the brace member  
2   extending substantially parallel with respect to the support arm.

3

4           FIG. 10 is a top view of the present invention showing the brace member  
5   extending at an angle with respect to the brace member.

## DETAILED DESCRIPTION OF THE INVENTION

### *A. Overview*

Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, FIGS. 1 through 11 illustrate an implement mounting system 10, which comprises a support frame 20 having a pair of side supports 24 and a rear support 22, a ball joint 40 attached to the rear support 22, and a support arm 30 movably attached to the ball joint 40 for rotating about 3 main axes. A brace member 50 is attached between the support frame 20 and the support arm 30 for reducing the amount of side-to-side movement of the support arm 30. The ball joint 40 is comprised of a ball-and-socket structure for providing various pivoting movements of the support arm 30.

### *B. Support Frame*

As shown in Figures 1 through 6 of the drawings, a support frame 20 is preferably utilized with the present invention. The support frame 20 is preferably attached to the belly of a tractor or other related vehicle. The support frame 20 is preferably formed so as to not interfere with a front-end loader or other attachment to the front of the tractor. The support frame 20 may have various structures capable of mounting to a tractor frame as can be appreciated.

As best shown in Figures 1 and 2 of the drawings, the support frame 20 preferably has a pair of side supports 24 and a rear support 22 attached between the rear ends of the side supports 24. The side supports 24 are preferably attached to the lower frame of the tractor utilizing conventional fasteners such as but not limited to bolts and the like. Various other bracing and reinforcement structures may be utilized to construct the support frame 20 other than shown in the attached drawings.

1     **C.     *Ball Joint***

2             As shown in Figures 1 through 4 of the drawings, a ball joint **40** is provided for  
3 movably supporting the support arm **30**. The ball joint **40** is preferably comprised of a  
4 ball-and-socket structure for providing various pivoting movements of the support arm  
5 **30**. Figure 7 illustrates the three main axes of pivoting (X, Y and Z), however the ball  
6 joint **40** inherently allows pivoting along various other axes.

7  
8             The ball joint **40** may be attached directly to the tractor frame, however the ball  
9 joint **40** is preferably attached directly to the support frame **20**. The ball joint **40** may  
10 be attached to the rear support **22** of the support frame **20** as shown in Figures 1  
11 through 4 of the drawings.

12  
13            A cuff structure **32** extending from the rear support **22** preferably engages the  
14 ball joint **40** via a pin member as shown in Figures 1 through 6 of the drawings.  
15 Alternatively, the cuff structure **32** may be attached to the first end of the support arm  
16 **30** as shown in Figures 7 and 8 of the drawings. The ball joint **40** allows the support  
17 arm **30** to have three main movements: lift, roll and yaw.

18  
19            The ball joint **40** is preferably centrally positioned along the rear support **22** as  
20 best shown in Figures 3 and 4 of the drawings. However, the ball joint **40** may be  
21 positioned at various other locations along the rear support **22**.

22  
23     **D.     *Support Arm***

24            The support arm **30** is an elongate structure having a first end and a second end  
25 as best shown in Figures 1 and 8 of the drawings. The first end of the support arm **30**  
26 is attached to the ball joint **40** as further shown in Figures 1 and 8 of the drawings.

27  
28            The second end receives an attachment structure for an implement **12**. The  
29 attachment structure is capable of supporting various types of implements **12** such as

1 but not limited to blades, plows, brushes and the like. For example, a front joint **36** is  
2 preferably attached to the second end of the support arm **30** for allowing pivoting of  
3 the implement **12** independently of the movement of the support arm **30** such as pitch  
4 and yaw.

5  
6 **E. Brace Member**

7 A brace member **50** is provided for stabilizing the horizontal side-to-side  
8 movements of the support arm **30**. The brace member **50** is preferably attached  
9 between the support frame **20** and the support arm **30**. However, the brace member **50**  
10 may be directly attached to the tractor frame.

11  
12 The brace member **50** is preferably attached to the support frame **20** at a vertical  
13 height substantially similar to the ball joint **40** as shown in Figures 2 and 7 of the  
14 drawings. This allows for the uninterrupted vertical movement of the support arm **30**  
15 while limiting the horizontal movement of the support arm **30**.

16  
17 The brace member **50** has an angle with respect to the support arm **30** for  
18 reducing side-to-side movement of the support arm **30** as best shown in Figures 8, 10  
19 and 11 of the drawings. The angle between the support arm **30** and the brace member  
20 **50** is preferably less than 75 degrees (e.g. 0 degrees to 74 degrees), though various  
21 other angles may be utilized.

22  
23 As shown in Figures 1 through 4 of the drawings, the brace member **50** is  
24 preferably attached to the support frame **20** via a ball-and-socket joint. The brace  
25 member **50** is also preferably attached to the support arm **30** via a ball-and-socket  
26 joint.

1     ***F. Cross Member***

2             A cross member **34** is preferably attached transversely to the support arm **30** as  
3 shown in Figures 1 through 8 of the drawings. The cross member **34** has an elongate  
4 structure and has two opposing ear structures for receiving a pair of vertical actuators  
5 **16** for allowing control of the lift and roll movements. The cross member **34** is  
6 preferably attached to a central location upon the support arm **30** as shown in Figures 1  
7 through 4 of the drawings.

8  
9             The brace member **50** is attached near a distal end of the cross member **34**,  
10 wherein the distal end of the cross member **34** is on an opposite side of the support  
11 arm **30** of where the brace member **50** is attached to the support frame **20** as shown in  
12 Figures 1 and 8 of the drawings. The brace member **50** may be attached to a bracket  
13 member that is attached to the cross member **34** as best shown in Figure 4 of the  
14 drawings.

15  
16     ***G. Actuators***

17             As shown in Figure 1 of the drawings, a pair of horizontal actuators **14** are  
18 preferably utilized within the present invention that control the yaw and pitch of the  
19 implement **12** attached to the support arm **30**. The horizontal actuators **14** are  
20 preferably attached to the support arm **30** near the first end thereof as shown in Figure  
21 1 of the drawings.

22  
23             A pair of vertical actuators **16** are preferably attached between the side supports  
24 **24** of the support frame **20** (or the tractor frame) and the cross member **34** that control  
25 the lift and roll of the implement **12** attached to the support arm **30**. The actuators **14**,  
26 **16** are preferably connected with ball-and-socket joint structures to allow for free  
27 movement of the support arm **30**. The actuators **14**, **16** are also preferably comprised  
28 of hydraulic cylinders, however various other actuator structures may be utilized such  
29 as but not limited to electrical actuators.

## **H. Operation**

In use, the support frame **20** is attached to a lower portion of a tractor frame. The desired implement **12** is attached to the distal second end of the support arm **30** as desired. The actuators are fluidly connected to the hydraulic system of the tractor or an independent hydraulic system.

If the user desires to lift/lower the implement **12**, the vertical actuators **16** are retracted/extended accordingly as shown in Figures 5 and 6 of the drawings. As the implement **12** is lifted/lowered, the support arm **30** freely pivots along the X axis of the ball joint **40** as shown in Figure 7 of the drawings. As the support arm **30** is lifted/lowered, the brace member **50** will apply a side-to-side horizontal force upon the support arm **30** which the ball joint **40** will allow the support arm **30** to accordingly move a finite distance to the side (pivoting along the Y axis of Figure 7). To reduce the amount of side-to-side movement caused by the brace member **50** during lifting/lowering, a longer brace member **50** is desired.

As shown in Figures 3 and 4 of the drawings, if the user desires to roll the implement **12**, the vertical actuators **16** are retracted/extended accordingly (usually by retracting one actuator and extending another actuator, however retracting/extending only one actuator will accomplish the same). As the implement **12** is lifted/lowered, the support arm **30** freely pivots along the Z axis of the ball joint **40** as shown in Figure 7 of the drawings.

If the user desires to change the pitch or yaw of the implement **12**, the horizontal actuators **14** are retracted/extended accordingly. Control of the pitch and yaw of the implement **12** does not affect the support arm **30**.

1           As to a further discussion of the manner of usage and operation of the present  
2 invention, the same should be apparent from the above description. Accordingly, no  
3 further discussion relating to the manner of usage and operation will be provided.  
4

5           With respect to the above description then, it is to be realized that the optimum  
6 dimensional relationships for the parts of the invention, to include variations in size,  
7 materials, shape, form, function and manner of operation, assembly and use, are  
8 deemed to be within the expertise of those skilled in the art, and all equivalent  
9 structural variations and relationships to those illustrated in the drawings and  
10 described in the specification are intended to be encompassed by the present invention.  
11

12           Therefore, the foregoing is considered as illustrative only of the principles of  
13 the invention. Further, since numerous modifications and changes will readily occur to  
14 those skilled in the art, it is not desired to limit the invention to the exact construction  
15 and operation shown and described, and accordingly, all suitable modifications and  
16 equivalents may be resorted to, falling within the scope of the invention.